

January 29, 2008

MEMORANDUM

TO: Jim Johnston, PE; DEQ Idaho Falls Regional Office Administrator.
Greg Eager, PE; DEQ Idaho Falls Regional Office Engineering Manager.

FROM: Charlie Mazzone; DEQ Idaho Falls Regional Office Water Quality Engineer.

SUBJECT: Permit Renewal Staff Analysis: City of Dubois Wastewater Treatment and Reuse Facility; LA-000166-02.

1.0 Purpose

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400.04 *Application Processing Procedure – Contents of the Staff Analysis* for issuing wastewater reuse permits. Specifically, this staff analysis shall briefly state the principal facts and the significant questions considered in preparing the permit conditions, and a summary of the basis for the conditions with references to applicable requirements and supporting materials.

2.0 Process Description

The Dubois wastewater treatment facility provides primary and secondary lagoon treatment of wastewater, wastewater storage, disinfection, and land application of wastewater to 49 acres of crops. Cells A and B are non-aerated, facultative lagoons, and Cell 3 is a winter storage lagoon. All three lagoons are lined with 60 mil HDPE. The lagoons are operated in a series connection, with no valves present to allow for cell bypass. Class C wastewater effluent (IDAPA 58.01.17.600.07 et. seq.: *Specific Permit Conditions – Direct Use of Municipal Reclaimed Wastewater*) is chlorine disinfected to a maximum concentration of 23 organisms per 100 mL, then slow infiltration land applied during the growing season. Wastewater is applied to one 49 acre field with two wheel lines.

Table 2.1 Lagoon Data

Lagoon	Description	Acreage	Depth (feet)	Volume (gallons)	Storage (gallons)
Cell A	Non-aerated, facultative lagoon	3.2	6	5,720,000	
Cell B	Non-aerated, facultative lagoon	3.2	6	5,720,000	
Cell C	Winter storage lagoon	6.2	6	13,000,000	13,000,000
Total				24,440,000	13,000,000

3.0 Summary of Events

Events relevant to this permitting action are summarized below.

1995: the Wastewater Treatment Facility Planning Study was completed.

1996: construction was completed.

1997: the initial facility reuse permit was issued.

2002: the initial facility reuse permit expired.

2007: Permit renewal application was received by the DEQ.

4.0 Site Characterization

4.1 Climate

Dubois is 5150 feet in altitude, and is characterized by:

- 12 inches of annual precipitation with the greatest precipitation in May and June (39% of total annual precipitation);
- 100 frost free days;
- 23 inches per year evaporation.

4.2 Soils

There is no soil survey available for the facility. Land application area soil samples taken in 1996 composited 24 sample locations into two samples representing depths of six inches and eighteen inches. Soil texture based on CEC is loamy sand for both depths, but sandy loam based on sieve analysis (6 inch depth – 66.6% sand, 18.0% silt, 15.4% clay; 18 inch depth – 57.6% sand, 24.0% silt, 18.4% clay). A sieve analysis on soil taken at eight feet deep resulted in sandy gravel classification.

Becreek gravelly fine sandy loam types occupy farmlands to the east and south of Dubois. Becreek soils are very deep, well drained and moderate permeability. Available water capacity is 3 to 4 inches.

As part of the reuse permit compliance activity requiring an irrigation schedule, it is recommended the irrigation schedule tailor sprinkler nozzle size and irrigation set times to the soil available water capacity. Wastewater treatment will be maximized when crops are irrigated no more than necessary, and it is anticipated that crop production will increase.

4.3 Ground water

Ground water at the facility is the Snake River aquifer, which varies from 273 to 355 feet below ground surface. Groundwater flow is generally in a southwest direction. Groundwater monitoring has not been deemed necessary at the facility to date, because total influent volumes were far below the irrigation water requirements for crops. This permit renewal requires an irrigation schedule be developed to coordinate the higher wastewater volumes with crop needs. However, the next permit renewal should evaluate irrigation efficacy and consider requiring groundwater monitoring if hydraulic application is not coordinated with crop irrigation requirements.

4.4 Surface Water Considerations

Beaver Creek contains the 100 year flood plain and runs parallel to the facility's west boundary at approximately 400 feet distant. Recent years have seen intermittent flow on the creek.

4.5 Buffer Zones and Disinfection Level

Buffer zones are greater than those recommended in DEQ guidance for Class C effluent (less than 23 organisms per 100 mL).

The facility reports the following buffer zones (DEQ recommended distances are in parenthesis):

- greater than 300 feet to any residence (at least 300 feet);
- greater than ½ mile to any public or private drinking water supply sources (at least 1,000 feet public; at least 500 feet private);
- greater than 50 feet to any publicly accessible area (at least 50 feet); and,
- greater than 450 feet to any surface water (at least 100 feet to permanent or intermittent surface water other than irrigation ditches and canals; at least 50 feet to temporary surface water and irrigation ditches and canals).

The *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater* recommends Scenario G install a three wire pasture fence around the land application unit, posted in each corner and every 500 feet along the perimeter with "Sewage Effluent Application – Keep Out". The Dubois facility is both posted and surrounded with a three wire pasture fence.

Given the above conditions, the facility must disinfect to a maximum concentration of 23 organisms per 100 mL (IDAPA 58.01.17 *Reclamation & Reuse of Municipal & Industrial Wastewater*, Section 600 *Specific Permit Conditions*).

5.0 Historic and Proposed Site Loading, Projected Environmental Impacts, and Related Permit Recommendations

5.1 Wastewater Quality and Flow

5.1.1 Influent

The Dubois wastewater treatment facility has a design influent flow of 113,500 gallons per day summer (4 months) and 60,000 gallons per day winter (8 months) totaling 28.5 million gallons per year (MGY).

Influent volumes are not a reporting requirement, so actual influent volumes are not known; however, a Parshall flume meter does exist at the facility, and it is recommended the facility continue to monitor influent volumes.

Influent wastewater quality is also unknown. The facility design was based on average strength domestic wastewater, as no industrial facilities exist in Dubois.

5.1.2 Effluent

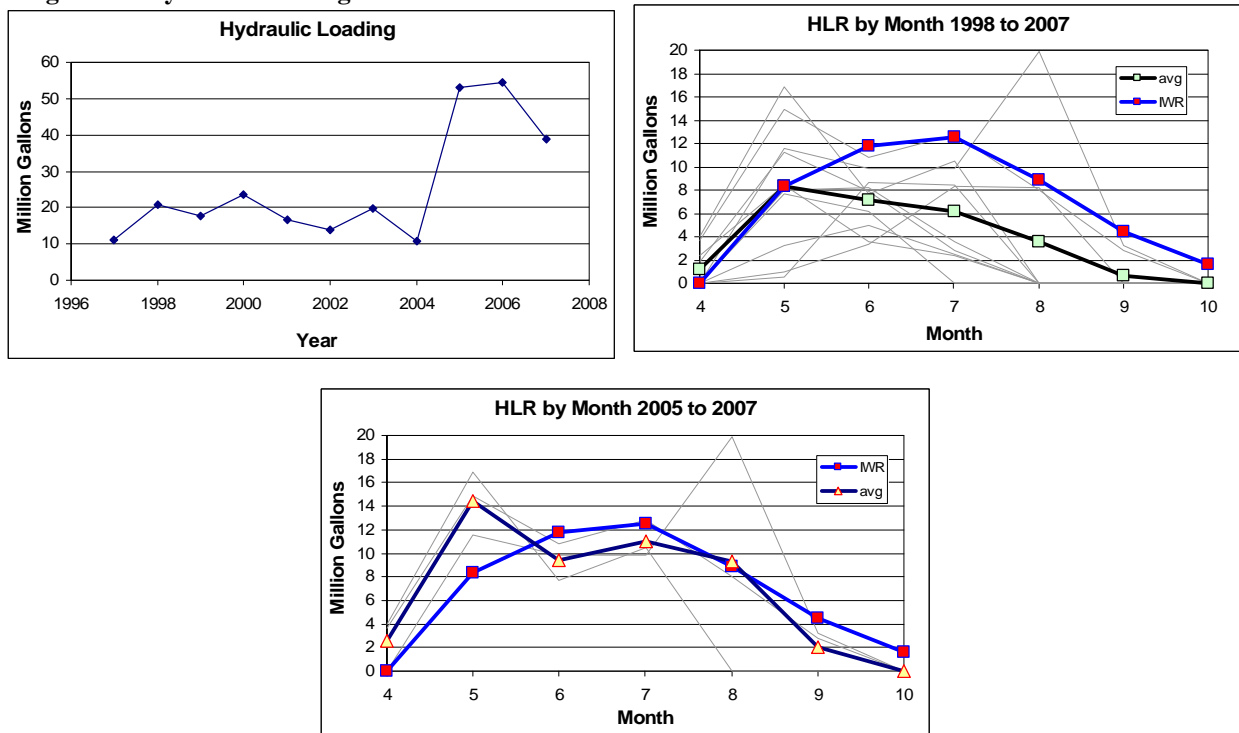
Effluent characteristics are shown in Table 5.1, hydraulic loading volumes are shown in Figure 5.1, and total nitrogen and COD loading rates are shown in Figure 5.2. Total coliform reporting has not been consistent; reported results show consistently high values exceeding the permit

required value. In 2006, only E. coli was reported after May of that year. It appears there may be chlorination issues resulting in inadequate disinfection.

Table 5.1 Reuse Wastewater Characteristics

Constituent	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Avg
BOD, ppm	2		32	18	15			27	15	34	20
COD, mg/L	5				140			232		97	119
N, Total, mg/L	4				14			26		5	12
P, mg/L	2				2			5		1	2.36
TDS, mg/L	329				469			597		283	419
TSS, mg/L			32	57	29			49	29	35	38

Figure 5.1 Hydraulic loading rates



5.2 Loading Rates – General

Constituent loading rates are summarized in Table 5.2 below. Note that the constituent concentrations are averages of 1997 to 2006 annual report values; however, some constituents were not sampled annually (see Table 5.1). The constituent average concentrations were applied to 2006 wastewater application volume of 54.34 million gallons (the largest application volume to date) for conservative results. Note that under those *potential* conditions that nitrogen application is greater than wheat uptake, and phosphorus application is greater than the recommended limit. Under actual conditions, 2006 hydraulic loading surpassed alfalfa uptake; otherwise, actual loading rates are within recommended limits.

Table 5.2 Loading Rates

Parameter	Recommended Limit*	Averaged Concentrations at Maximum Wastewater Application Volume	
		Concentration	Rate
COD	50 lb/ac*d	119 mg/L	5 lb/ac*d
Nitrogen	150% of crop uptake: <ul style="list-style-type: none"> Alfalfa: 155 lb/ac; Wheat: 71 lb/ac. 	12.3 mg/L	113 lb/ac
Sodium	SAR < 10	No data	
Wastewater loading rate	Less than crop uptake of: <ul style="list-style-type: none"> alfalfa: 47.65 MG/yr; wheat: 39.52 MG/yr. 	N/A	Average = 25.51 MG/yr; year 2006 = 54.34 MG; see Section 5.5.2.

***Recommended Limit Notes:**

1. Nitrogen recommended limits were derived from averaged crop yields at the facility (2.07 t/ac alfalfa; 39.5 bu/ac wheat) applied to typical values of nitrogen uptake (50 lb N/t alfalfa; 1.2 lb N/bu wheat).
2. Wastewater loading rate recommended limit based on crop irrigation water requirements (University of Idaho, Kimberly R & E Center).

5.3 Wastewater Constituent Loading

Sampled nitrogen and COD loading rates are shown in Figure 5.2. Actual loading rates are below recommended limits.

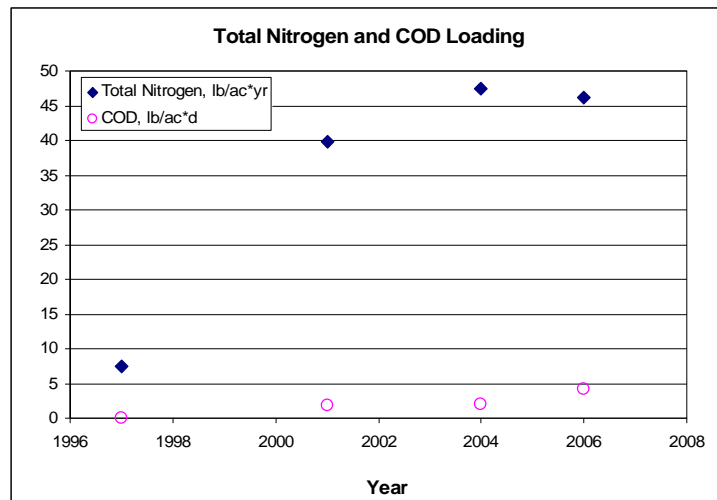


Figure 5.2 Total Nitrogen and COD Loading Rates

5.4 Crop Nitrogen Requirements

Nitrogen supplied by wastewater and crop nitrogen requirements are listed below for comparison. The facility is in compliance with nitrogen loading requirements.

Nitrogen supplied by wastewater:

A. Maximum expected nitrogen supply:

113 lb/ac*yr = 1997 to 2006 average nitrogen concentration of 12.25 mg/L at the 2006 wastewater loading rate of 54.34 million gallons.

B. Average nitrogen supply:

35 lb/ac*yr = average yearly nitrogen supplied through wastewater, 1997 to 2006.

Alfalfa nitrogen uptake:

A. Theoretical nitrogen uptake values (values applied to the average yield of 2.07 t/ac are in parenthesis):

Crop uptake: 50 lb/t (104 lb/ac);

Recommended limit of 150% of uptake: 75 lb/t (155 lb/ac).

B. Tissue sample values:

Total nitrogen removed: 107 lb/ac;

150% of total nitrogen removed: 161 lb/ac.

Wheat nitrogen uptake:

A. Theoretical nitrogen values (values applied to the average yield of 39.5 bu/ac are in parenthesis):

Crop uptake: 1.2 lb/bu (47 lb/ac);

Recommended limit of 150% of uptake: 1.8 lb/bu (71.1 lb/ac).

B. Sampled values:

Total nitrogen removed: 53.5 lb/ac;

150% of total nitrogen removed: 80.2 lb/ac.

5.5 Hydraulic Loading

5.5.1 Non Growing Season (NGS) Hydraulic Loading

It is recommended that Dubois not land apply in the non-growing season. The facility has adequate storage to contain all non-growing season inflow.

5.5.2 Growing Season (GS) Hydraulic Loading

Hydraulic loading at the Dubois facility appears to be excessive in the early months of the growing season, based on irrigation water requirement (IWR, University of Idaho, Kimberly R & E Center) and annual reports. Figure 5.1 *Hydraulic Loading Rates* shows actual irrigation and crop IWR, and a recent trend toward over application in the early growing season.

A water balance based on averaged monthly hydraulic applications and alfalfa irrigation water requirement (IWR) is shown in Figure 5.3. Note that hydraulic loading from the years 2005 through 2007 increased substantially; those years are also averaged separately in the water balance.

The irrigation schedule, required with this permit revision, should address timely application of stored wastewater and irrigation water, and thereby increase treatment efficiency and reduce chances of wastewater infiltrating beyond the crop root zone. If the recent increase in available water is an anomaly, the facility may also want to consider decreasing crop acreage to better accommodate water availability, as well as utilizing the maximum drawdown permissible for lagoon (cell) B, as outlined in the facility O&M manual.

Figure 5.3 Facility Water Balance

		Hydraulic Loading Water Balance							
		April	May	June	July	August	September	October	Total
Alfalfa IWR									
Gallons	0	8,348,114	11,813,195	12,493,517	8,883,005	4,473,855	1,642,878	47,654,564	
Total Water Applied									
Avg '97-'07	1,174,370	8,346,450	7,121,050	6,109,570	3,611,270	604,980	0	26,967,690	
Avg '05-'07	2,531,333	14,421,500	9,452,300	11,016,100	9,301,600	2,016,600	0	48,739,433	
Excess Water									
Avg '97-'07	1,174,370	-1,664	-4,692,145	-6,383,947	-5,271,735	-3,868,875	-1,642,878	-20,686,874	
Avg '05-'07	2,531,333	6,073,386	-2,360,895	-1,477,417	418,595	-2,457,255	-1,642,878	1,084,869	

5.6 Cropping Plan

The latest cropping plan, from the 1996 O&M Manual, called for grain crops alternated with alfalfa every five years. The facility has been growing mostly alfalfa and grass mix, with the exception of wheat in 1998 and 1999, and one crop of oat straw in 2004. The cropping plan should be revised to reflect actual activity, and incorporated into the permit renewal required irrigation schedule.

6.0 Site Management and Related Permit Recommendations

6.1 Plan of Operation (*Plan*, Operation and Maintenance Plan, or O&M Plan)

The *Plan* should be updated to reflect changes at the facility which have occurred since the *Plan* was created in 1986. See section 7.2 of this document.

6.2 Odor Management Plan (Nuisance Odor Plan)

Although odor management is briefly discussed in the existing *Plan*, the procedures should be more extensively reviewed. See section 7.2 of this document.

6.3 Grazing Plan

Grazing is discouraged on municipal wastewater applied sites, but is allowed if it follows a DEQ approved grazing plan. Dubois does not have an approved grazing plan; therefore, no grazing is allowed at the facility.

6.4 Waste Solids (Sludge) Management Plan

All waste solids, including dredgings and sludges, have the potential to contaminate waters of the state, as well as create health hazards and nuisance conditions. The permittee's Waste Solids Management Plan is required in order to minimize the potential negative impacts of waste solids handling.

6.5 Lagoons: Integrity, Sludge Depths, and Seepage Tests

The lagoons at the Dubois facility are lined with 60 mil HDPE. All three lagoons passed seepage tests conducted in 2004.

Sludge depth monitoring and action depths should be part of the Waste Solids (Sludge) Management Plan required with this permit renewal.

The DEQ requires all lagoons to be seepage tested every five years to determine liner integrity and meet IDAPA 58.01.16.493. To document compliance with IDAPA 58.01.493 et seq. in the Wastewater Rules, seepage test results should be included with the permit renewal package at that time.

7.0 Status of Current Activities & Recommended Activities for the New Permit

7.1 Current Activities

A detailed Plan of Operation and lagoon seepage tests were required by the previous facility permit and were submitted by the facility.

IDAPA 58.01.16.202 *Classification of Public Wastewater Systems* requires that all systems be classified. Further, IDAPA 58.01.16.203 *Public Wastewater System Operator Licensure Requirements* requires that each system be under the responsible charge of an operator who holds a valid license equal to or greater than the classification of the system. Finally, IDAPA 58.01.16.203.07 *Land Application Operator Compliance Deadline* requires licensed land application operating personnel by April 15, 2007. The Dubois facility is a Class I facility for both wastewater collection and treatment. Operator Richard Hunter holds Class I licenses in both collection and treatment, but has not received licensure in land application to date.

7.2 Required Activities

Renewed Permit Section E – *Compliance Schedule for Required Activities* prescribes compliance activities to be completed by the facility, and their respective completion deadlines. The compliance activities are described below, according to the compliance activity number.

CA-066-01: A **Plan of Operation** manual update. The original Plan of Operation (*Plan*), also known as the O&M Manual, was written in June of 1996. The *Plan* needs to be updated to reflect current operations, including irrigation water delivery and storage, as well as an irrigation schedule tailored to the soils and crops existent at the facility. A *Plan of Operation Checklist (Checklist)* is located in the DEQ Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater.

CA-166-02: It is highly recommended that a qualified professional review and revise the facility's **irrigation schedules**. The revised irrigation schedule can then be incorporated into the Plan of Operation.

It is recommended the irrigation schedule design incorporate the following issues relevant to the Dubois facility:

- Prioritize wastewater treatment over crop production.
- Avoid leaching of applied water by tailoring sprinkler nozzle size and irrigation set times to the soil available water capacity and actual crops grown.
- Reevaluate the ability of wheat to uptake nitrogen supplied.
- The irrigation schedule should match the crop irrigation water requirements.
- Create a schedule based on the actual crops grown.
- Evaluate future trends in irrigation water available to the facility, and base the schedule on those trends.
- Timely application of stored wastewater and irrigation water will increase treatment efficiency and reduce chances of wastewater infiltrating beyond the crop root zone. If the recent increase in available water is an anomaly, the facility may also want to consider decreasing crop acreage to better accommodate water availability, as well as utilizing the maximum drawdown permissible for lagoon (cell) B, as outlined in the facility O&M manual.

CA-166-03: The DEQ requires an **Odor Management Plan** so facilities have a reference on hand for avoiding and addressing odors. Odor Management Plans include wastewater treatment systems, reuse facilities, and other operations associated with the facility, and incorporate specific design considerations, operation and maintenance procedures, and management practices to be employed to minimize odors. Plans also include procedures to respond to an odor incident if one occurs, including notification procedures.

CA-166-04: a **Runoff Management Plan** describes control structures and other Best Management Practices (e.g. – collection basins, berms, etc.) designed to prevent runoff from any site or fields used for wastewater reuse, except in the event of a 25 year, 24 hour storm event or greater, using the Western Regional Climate Center Precipitation Frequency Map, Figure 28 Isopleth of 25-YR, 24-HR Precipitation. For the Dubois site, the 25 year, 24 hour event is 2.0 inches.

CA-166-05: a **Waste Solids Management Plan** describes how waste solids generated at the facility will be handled and disposed of to meet the requirements of Permit Section I, No. 5. Waste solids have the potential to contaminate waters of the state, as well as create health hazards and nuisance conditions. The permittee's Waste Solids Management Plan is required in order to minimize the potential negative impacts of waste solids handling.

CA-166-06: current DEQ rules require **Seepage Tests** on all lagoons every five years, conducted according to the most recent DEQ procedures.

7.3 Permit Section G – Monitoring Requirements

Permit Section G contains monitoring requirements for the facility. See Permit Section G for exact descriptions of monitoring and calculations required.

Table 7.1 below is a recommended monitoring schedule for the Permit Section G monitoring requirements. Note that calculation requirements listed in the Permit Section G *Facility Monitoring Table* are not listed in Table 7.1 – only monitoring requirements are listed.

Table 7.1 Monitoring Schedule

Medium	Daily	Weekly	Monthly	Annually	Other frequencies
Wastewater – lagoon effluent	Volume to HMU	Total coliform	Grab sample lab analysis	Flow meter calibration.	
Supplemental irrigation water	Volume to each HMU			1. Flow meter calibration; 2. Backflow testing; 3. Grab sample lab analysis.	
Soil				Composite sample for lab analysis.	First year of permit soil sample & analysis.
Fertilizer				Quantity applied.	
Crop					Each harvest: crop data, tissue analyses and calculations.

COD wastewater monitoring is no longer recommended for the facility due to historical loading rates below 5 pounds per acre*day (sampled four separate years with values ranging from 0.04 to 4.4 lb/ac*d, with an average of 2.0 lb/ac*d).

7.4 Permit Section H – Standard Reporting Requirements

Permit Section H lists the facility reporting requirements. Table 7.2 summarizes the Annual Report requirements which are derived from monitoring.

Table 7.2 Annual Report Requirements Generated by Monitoring Requirements

MEDIUM	ANNUAL REPORT REQUIREMENTS				
	Monitoring Frequency				
	Daily	Weekly	Monthly	Annually	Other
Wastewater – lagoon effluent	1. Volume in gal/month, gal/yr, in./ac*month, in./ac*yr. 2. <i>Calculations:</i> - nitrogen and phosphorus applied in lb/ac*yr.	Coliform analysis results.	Lab analysis results	Flow meter calibration date and results.	
Supplemental irrigation water	1. Volume in gal/month, gal/yr, in./ac*month, in./ac*yr.			1. Flow meter calibration date and results; 2. Backflow testing date and results; 3. Lab analysis results.	
Soil				Lab analysis results.	Permit first year lab analysis results.
Fertilizer				1. Total pounds applied. 2. <i>Calculations:</i> - nitrogen and phosphorus applied in lb/ac*yr.	
Crop	1. <i>Per harvest monitoring</i> must be reported for each cutting and as facility annual totals, for each HMU. <ol style="list-style-type: none"> Facility annual totals: <ul style="list-style-type: none"> facility total crop yield; facility total nitrogen, ash, and phosphorus removal. Per HMU totals: <ul style="list-style-type: none"> crop name; total number of cuts (harvests) per year; crop moisture; per harvest crop yield in tons/ac or lb/ac (dry basis); tissue analysis (green) results; per harvest dry basis nitrogen, ash, and phosphorus removal in lb/ac and total pounds. 2. <i>Annual monitoring</i> calculations must be reported as the volume of irrigation water required for crop growth, in inches/acre and total gallons/HMU for each growing season month.				

Other Annual Report contents, as stated in the permit, are:

1. The status of compliance activities.
2. An interpretive discussion of monitoring data with particular respect to environmental impacts by the facility. The report should interpret the monitoring data, including the lab analyses, and discuss any environmental impacts revealed by the data.
3. All laboratory reports containing the sample results for Section G *Monitoring Requirements*.

8.0 Conclusions and Recommendations

The DEQ recommends that the City of Dubois conduct the new permit required monitoring and report the required data to evaluate system performance, permit compliance, and guarantee that environmental degradation does not occur at the facility.

9.0 Recommendation for Issuance or Denial of Permit

Staff recommends that the attached draft Municipal Wastewater Reuse Permit be issued. The permit specifies loading limits for nitrogen, non-growing season and growing season hydraulic loading rates, and establishes monitoring requirements to adequately protect public health and the environment.

10.0 References

R.G. Allen and C.E. Brockway – "Estimating Consumptive Irrigation Requirements for Crops in Idaho" University of Idaho, August, 1983.